

COMPLETE SET OF CLAIMS

1. (Currently Amended) A semiconductor laser, comprising:

an n-type cladding layer that has n-type conductivity;

an active layer formed on top of the n-type cladding layer;

a p-type cladding base layer that is formed on top of the active layer and has p-type conductivity;

a current-blocking layer that is formed on specified parts of an upper surface of the p-type cladding base layer and substantially has n-type conductivity, wherein the current-blocking layer includes either $\text{Al}_{0.5}\text{In}_{0.5}\text{P}$ or $(\text{Al}_x\text{Ga}_{1-x})_{0.5}\text{In}_{0.5}\text{P}$, where $0.7 < x < 1$; and

a p-type buried cladding layer that has p-type conductivity and is formed so as to cover the current-blocking layer and contact remaining parts of the upper surface of the p-type cladding base layer,

wherein the current-blocking layer has at least two regions having different concentrations (hereafter "N1" and "N2" where $N1 < N2$) of n-type carriers, a region adjacent to an interface between the p-type cladding base layer and the p-type buried cladding layer having the N1 concentration of n-type carriers and a part or all of a remaining region of the current-blocking layer region having the N2 concentration, and the current-blocking layer (13) having a lower refractive index than the cladding base layer (5) and the buried cladding layer (7).

2. (Original) A semiconductor laser according to Claim 1,

wherein the current-blocking layer includes a first layer that contacts the p-type cladding base layer and a second layer that is provided on top of the first layer, a concentration

4 of n-type carriers in the first layer being N_1 and a concentration of n-type carriers in the second
5 layer being N_2 .

1 3. (Original) A semiconductor laser according to Claim 2,
2 wherein the first layer has a different composition to the second layer.

1 4. (Original) A semiconductor laser according to Claim 2,
2 wherein one of the first layer and the second layer is composed of a plurality of
3 sublayers that have at least two different compositions.

1 5. (Original) A semiconductor laser according to Claim 2,
2 wherein the second layer is co-doped with a p_2 concentration of p-type carriers
3 and an n_2 (where $n_2 > p_2$) concentration of n-type carriers, and n_2 and p_2 are set so that
4 $n_2 - p_2 = N_2$.

1 6. (Original) A semiconductor laser according to Claim 5,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

1 7. (Original) A semiconductor laser according to Claim 4,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

1 8. (Original) A semiconductor laser according to Claim 3,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

1 9. (Original) A semiconductor laser according to Claim 2,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

10. (Original) A semiconductor laser according to Claim 1,

wherein $0\text{cm}^{-3} \leq N1 \leq 10^{17}\text{cm}^{-3}$ and $N2 > 10^{17}\text{cm}^{-3}$.

11. (Currently Amended) A semiconductor laser, comprising:

an n-type cladding layer that has n-type conductivity;

an active layer formed on top of the n-type cladding layer;

a p-type cladding base layer that is formed on top of the active layer and has p-type conductivity;

a current-blocking layer that is formed on specified parts of an upper surface of the p-type cladding base layer and substantially has n-type conductivity, wherein the current-blocking layer includes either $\text{Al}_{0.5}\text{In}_{0.5}\text{P}$ or $(\text{Al}_x\text{Ga}_{1-x})_{0.5}\text{In}_{0.5}\text{P}$, where $0.7 < x < 1$; and

a p-type buried cladding layer that has p-type conductivity and is formed so as to cover the current-blocking layer and contact remaining parts of the upper surface of the p-type cladding base layer,

the current-blocking layer having a region with p-type conductivity adjacent to the interface between the p-type cladding base layer and the p-type buried cladding layer and another region with n-type conductivity, and the current-blocking layer (13) having a lower refractive index than the p-type cladding base layer (5) and the p-type buried cladding layer (7).

12. (Currently Amended) A semiconductor laser, comprising:

an n-type cladding layer that has n-type conductivity;

an active layer formed on top of the n-type cladding layer;

a p-type cladding base layer that is formed on top of the active layer and has p-type conductivity;

an interjacent layer that has p-type conductivity and is formed on specified parts of an upper surface of the p-type cladding base layer and contacts the p-type cladding base layer;

a current-blocking layer that is formed on the interjacent layer and has n-type conductivity, wherein the current-blocking layer includes either $\text{Al}_{0.5}\text{In}_{0.5}\text{P}$ or $(\text{Al}_x\text{Ga}_{1-x})_{0.5}\text{In}_{0.5}\text{P}$, where $0.7 < x < 1$; and

a p-type buried cladding layer that has p-type conductivity and is formed so as to cover the current-blocking layer and contact remaining parts of the upper surface of the p-type cladding base layer,

the interjacent layer being positioned between the current-blocking layer and the p-type cladding base layer so that a lower surface of the current-blocking layer is separated from an upper surface of the p-type cladding base layer, and the current-blocking layer (13) having a lower refractive index than the p-type cladding base layer (5) and the p-type buried cladding layer (7).

13. (Original) A semiconductor laser according to Claim 12,

wherein the p-type buried cladding layer has a higher refractive index of light than the current-blocking layer.

14. (Original) A semiconductor laser according to Claim 11,

wherein the p-type buried cladding layer has a higher refractive index of light than the current-blocking layer.

15. (Original) A semiconductor laser according to Claim 10,

2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 16. (Original) A semiconductor laser according to Claim 9,
2 wherein the p-type buried cladding layer has a higher refractive index of laser
3 light than the current-blocking layer.

1 17. (Original) A semiconductor laser according to Claim 8,
2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 18. (Original) A semiconductor laser according to Claim 7,
2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 19. (Original) A semiconductor laser according to Claim 6,
2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 20. (Original) A semiconductor laser according to Claim 5,
2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 21. (Original) A semiconductor laser according to Claim 4,
2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 22. (Original) A semiconductor laser according to Claim 3,
2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 23. (Original) A semiconductor laser according to Claim 2,
2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 24. (Original) A semiconductor laser according to Claim 1,
2 wherein the p-type buried cladding layer has a higher refractive index of light
3 than the current-blocking layer.

1 25. (Currently Amended) A semiconductor laser manufacturing method, comprising:
2 a first process for successively forming an n-type cladding layer having n-type
3 conductivity, an active layer, and a p-type cladding base layer having p-type conductivity on top
4 of one another, before forming a current-blocking layer, which substantially has n-type
5 conductivity, on specified parts of an upper surface of the p-type cladding base layer;
6 a second process for performing thermal cleaning in a presence of a specified gas
7 after the first process has finished;
8 a third process for forming, after the second process has finished, a p-type buried
9 cladding layer, which has p-type conductivity, so as to cover the current-blocking layer and
10 contact remaining parts of the upper surface of the p-type cladding base layer,

11 the first process including:
12 a first subprocess for forming a region of the current-blocking layer that is
13 adjacent to the interface between the p-type cladding base layer and the p-type buried cladding
14 layer with a concentration (hereafter, "N1") of n-type carriers, wherein the current-blocking layer
15 includes either $\text{Al}_{0.5}\text{In}_{0.5}\text{P}$ or $(\text{Al}_x\text{Ga}_{1-x})_{0.5}\text{In}_{0.5}\text{P}$, where $0.7 < x < 1$; and
16 a second subprocess for forming another region in at least part of the current-
17 blocking layer with a concentration (hereafter, "N2") of n-type carriers, where $N1 < N2$, and
18 wherein the current-blocking layer (13) has a lower refractive index than the p-
19 type cladding base layer (5) and the p-type buried cladding layer (7).

1 26. (Original) A semiconductor laser manufacturing method according to Claim 25,
2 wherein the first process produces the current-blocking layer by forming a first
3 layer that contacts the p-type cladding base layer and a second layer on top of the first layer, a
4 concentration of n-type carriers being N1 in the first layer and N2 in the second layer.

1 27. (Original) A semiconductor laser manufacturing method according to Claim 26,
2 wherein the first process forms the first layer from a different composition of
3 materials to the second layer.

1 28. (Original) A semiconductor laser manufacturing method according to Claim 26,
2 wherein the first process produces one of the first layer and the second layer by
3 forming sublayers from at least two different compositions of materials.

1 29. (Original) A semiconductor laser manufacturing method according to Claim 26,
2 wherein the first process co-dopes the second layer with a p_2 concentration of
3 p-type carriers and an n_2 (where $n_2 > p_2$) concentration of n-type carriers, and $N_2 = (n_2 - p_2)$.

1 30. (Original) A semiconductor laser manufacturing method according to Claim 29,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

1 31. (Original) A semiconductor laser manufacturing method according to Claim 28,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

1 32. (Original) A semiconductor laser manufacturing method according to Claim 27,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

1 33. (Original) A semiconductor laser manufacturing method according to Claim 26,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

1 34. (Original) A semiconductor laser manufacturing method according to Claim 25,
2 wherein $0 \text{ cm}^{-3} \leq N_1 \leq 10^{17} \text{ cm}^{-3}$ and $N_2 > 10^{17} \text{ cm}^{-3}$.

1 35. (Currently Amended) A semiconductor laser manufacturing method, comprising:
2 a first process for successively forming an n-type cladding layer having n-type
3 conductivity, an active layer, and a p-type cladding base layer having p-type conductivity on top
4 of one another, before forming a current-blocking layer, which substantially has n-type
5 conductivity, on specified parts of an upper surface of the p-type cladding base layer;

a second process for performing thermal cleaning in a presence of a specified gas after the first process has finished;

a third process for forming, after the second process has finished, a p-type buried cladding layer, which has p-type conductivity, so as to cover the current-blocking layer and contact remaining parts of the upper surface of

the p-type cladding base layer,

the first process forming the current-blocking layer so as to include a region with n-type conductivity and a region with p-type conductivity, the first process including:

a first subprocess for forming a region with p-type conductivity adjacent to an interface between the p-type cladding base layer and the p-type buried cladding layer; and

a second subprocess for forming a region with n-type conductivity in at least part of a remainder of the current-blocking layer,

wherein the current-blocking layer (13) has a lower refractive index than the p-type cladding base layer (5) and the p-type buried cladding layer (7), and

wherein the current-blocking layer includes either $\text{Al}_{0.5}\text{In}_{0.5}\text{P}$ or $(\text{Al}_x\text{Ga}_{1-x})_{0.5}\text{In}_{0.5}\text{P}$,

where $0.7 < x < 1$.

36. (Currently Amended) A semiconductor laser manufacturing method, comprising:

a first process for successively forming an n-type cladding layer having n-type conductivity, an active layer, a p-type cladding base layer having p-type conductivity, and an interjacent layer that has p-type conductivity and contacts the first p-type cladding base layer on top of one another, before forming a current-blocking layer, which substantially has n-type conductivity, on an upper surface of the interjacent layer;

a second process for performing thermal cleaning in a presence of a specified gas after the first process has finished;

a third process for forming, after the second process has finished, a p-type buried cladding layer, which has p-type conductivity, so as to cover the current-blocking layer and contact remaining parts of the upper surface of the p-type cladding base layer,

the interjacent layer being formed between the current blocking layer and the p-type cladding base layer so that a lower surface of the current-blocking layer is separated from an upper surface of the p-type cladding base layer,

wherein the current-blocking layer (13) has a lower refractive index than the p-type cladding base layer (5) and the p-type buried cladding layer (7), and

wherein the current-blocking layer includes either $\text{Al}_{0.5}\text{In}_{0.5}\text{P}$ or $(\text{Al}_x\text{Ga}_{1-x})_{0.5}\text{In}_{0.5}\text{P}$, where $0.7 < x < 1$.

37. (Previously Presented) A semiconductor laser according to Claim 2,

wherein the second layer is co-doped with p-type impurities and n-type impurities and has substantially n-type conductivity, and such that the concentration of n-type carriers is N_2 .

38. (Previously Presented) A semiconductor laser manufacturing method according to Claim 26,

wherein the first process co-dopes the second layer with p-type impurities and n-type impurities, such that the concentration of n-type carriers is N_2 .

39-43. (Cancelled)